

...to appraise

*the current state-of-the-art
and the next several years
in many technological areas
of interest to you...*

tfi FALL/WINTER 1968
Seminars

TECHNOLOGY
FORECASTING
INSTITUTE, INC.

1968

tfi Fall / Winter

TECHNOLOGY FORECASTING

A Subsidiary of Gordon and Breach,
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II

Seminars

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THOSE BUSINESS FIRMS and government agencies whose long term growth is dependent upon using the latest developments from an evolving technology are caught in the constantly recurring problem of educating key engineering, marketing, and management personnel in the latest developments within key technological areas.

Advanced engineers and design engineers who have been assigned to a production engineering project for one to three years find that they have been unable to maintain their knowledge about the state-of-the-art during that time period. Thus, when they are re-assigned to a new product or project, which has recently emanated from the research or advanced development stage, they find they face the difficulty of trying to use new technology with which they are only generally familiar.

To bridge the gap of this two to three year period, Technology

...about

MAXIMUM BENEFIT will be derived from the lectures and the discussion interchanges for industrial and government personnel engaged in the following activities:

Project Management	Advanced Engineering
Advanced Planning	Preliminary Design
Long Range Planning	Operations Research
Technological Forecasting	Product Planning
Development Engineering	Applied Research

Forecasting Institute, Inc., offers intensive seminars conducted by the most distinguished scientists and engineers in the world. These seminars are presented for the design engineer, advanced engineer, product planner, long range planner, and R&D manager, in order to expeditiously bring them up-to-date on the current state-of-the-art and examine a few of the potential applications that may evolve within the next several years. These seminars and symposia conducted by the world's leading protagonists within the technological areas are offered on a two- and three-day basis. The subject matter is sufficiently confined so that a reasonably intensive treatment may be developed. The courses or seminars are designed to provide a maximum interchange of information between the distinguished seminar leaders and the seminar attendees. Visual aids and other handout material will be provided to each seminar attendee.

the seminars

Since these seminars are designed as intensive programs to bring key industrial and government personnel up-to-date on the state-of-the-art, the proper attendee is one who has a background in engineering, science, or mathematics, or who has had some experience in applications of the fundamental disciplines. Thus, the prerequisites for the attendees are an undergraduate and/or graduate degree in one or more of the physical sciences such as chemistry, or physics, or a degree in mathematics or biology depending upon the particular seminar. Training in mathematics to these degree programs is suggested.

...in brief Government and industry are developing many new ways to forecast future technical developments, but the payoff comes when these projections are incorporated as part of the R&D planning process. This is done on two levels: when deciding on future work in a specific development project and when assigning priorities to the overall R&D effort. Systems being developed in the Navy and other branches of the federal government are able to integrate technological forecasts with data on future needs, probabilities of success, and potential funding levels. The computerized result is a complete ranking of all on-going and potential projects according to their overall worth. But care must be taken to ensure that the print-out remains a servant and not a ruler.

TOPICS

- I. The Systems Approach to Corporate Planning
 - a. Definition of the principal factors in planning
 - b. Assessing the R&D position in total planning cycle
 - c. The R&D cycle
- II. Factors in Establishing Corporate Goals
 - a. Policy: Strategy, Doctrine
 - b. Environment: Competition, External business environment
 - c. Technology: State-of-the-art, Forecasting (exploratory approach)
- III. Defining Corporate Goals
 - a. Corporate needs vs. wants / b. Social demands
- IV. Corporate Deficiency Analysis
 - a. Current capabilities
 - b. Forecasted new projects and products
 - c. Resources constraints
- V. Defining the Corporate Requirements
 - a. Functional objectives / b. Operational objectives
- VI. Translation to Technical Requirements
 - a. Methods
 - b. Quantitative techniques
 - c. Case studies
- VII. Integrating Company Objectives with R&D Planning
 - a. Coupling techniques
 - b. Technological forecasting methodologies (normative approach)
- VIII. Federal R&D Policy
 - a. Science policy planning / b. Decision making
- IX. Measuring Research Effectiveness
 - a. Citation indexing / b. Hindsight results
- X. Creativity and Technology Change
 - a. Invention / b. Innovation / c. Diffusion
- XI. Conclusion
 - a. State-of-the-art review
 - b. Probable course of future events

THE METHODOLOGY OF TECHNOLOGICAL FORECASTING:

The Exploratory and Normative Techniques and their Utility in R&D Planning

Course 100/Fee: \$325

Schedule and Location:

October 16-18, 1968, The Biltmore Hotel, New York City
 December 3-5, 1968, The International Hotel, Los Angeles
 February 4-6, 1969, The Biltmore Hotel, New York City
 March 26-28, 1969, Hotel Intercontinental, Geneva, Switzerland

MARVIN J. CETRON, B.S., M.S.

Head, Technological Forecasting and Appraisal Group

Exploratory Development Division

Headquarters of the Naval Material Command, Washington, D.C.

Mr. Cetron has been engaged in various technological planning roles in laboratories, Navy Headquarters, and in the Department of Defense, for more than fifteen years. He served as Head of the Planning Branch at the United States Naval Marine Engineering Laboratory; Engineering Assistant to the Technical Director of the Navy Applied Science Laboratory; and Head of the Management Planning Review Branch of the Applied Science Laboratory. He is a member of the Military Operations Research Symposia, the American Institute of Industrial Engineers, the Interservice Technological Forecasting Methodology Group, the Interagency Group for Research on Research, and the American Association for the Advancement of Science.

Mr. Cetron has worked with various government agencies both in this country and abroad, lectured at many academic institutions and to many professional groups. He has published numerous articles, co-authored several books, and contributed chapters to other books on long range planning, technological forecasting, and operations research in R&D. He holds a B.S. degree from Pennsylvania State College, a M.S. degree from Columbia University.

BODO BARTOCHA, Ph.D.

Staff Associate, Office of Planning and Policy Studies

National Science Foundation, Washington, D.C.

Prior to joining the Foundation in 1967, Dr. Bartocha was a Milton Research Fellow in Chemistry at Harvard University, and then served in various positions with the U.S. Navy. He gained his technical and managerial experience as Head, Propellant Branch of the Naval Ordnance Laboratory, Corona, California, and was Director of Research and Assistant Technical Director for Long Range Planning of the U.S. Naval Propellant Plant (now Naval Ordnance Station), Indian Head, Maryland. He also held an overseas appointment as Deputy Scientific Director of the Office of Naval Research Branch Office in London.

Dr. Bartocha has published extensively in the technical literature and is the holder of seven U.S. patents. He has worked with various foreign governments and professional organizations on cooperative R&D ventures and presented lectures and conducted seminars here and abroad on project selection in R&D science policy planning, resources allocations and involved social implications.

TOPICS

- I. Short Historical Review
 - Resistanceless State
 - Meissner Effect / Isotope Effect / Energy Gap / BCS Theory
 - Hard Type II Superconductors
 - Josephson Effect
 - High Temperature Superconductors
- II. Refresher Theory
 - Theory of Normal Fermi Metals
 - Electron-Phonon Interaction / Cooper Pairing
 - BCS Hamiltonian and Trial Wave Function
 - Physical Understanding of BCS Ground State
 - Energy Gap / Tunnelling Density of States
 - Flux Quantization and Electron Pairing
- III. High Field Type II Superconductors
 - Phenomenological Theory of Superconductivity
 - Ginzburg-Landau Equations
 - Type I and Type II Superconductors
 - High Magnetic Field Superconductors
 - Upper Critical Field, Critical Currents, Stability
 - Superconducting Magnets
 - Application of High Field Magnet Technology
 - Flux Motion in Type II Superconductors and Device Application
- IV. Quantum Mechanical Nature of the Superconducting Wave Function
 - Superconducting Phase Coherence
 - Josephson Effect
 - Devices Based on the Josephson Effect
 - Other Superconducting Devices
- V. Progress in High Temperature Superconductors
 - Transition Metal Alloys
 - Organic Molecular Superconductors
 - Thin Films
 - Theoretical Suggestion to Increase T_c
 - One and Two Dimensional Superconductors
 - Semiconducting Superconductors
 - Technological Impact of High Temperature Superconductors
- VI. Application of Superconducting Technology
 - Computer Elements and Memory Devices
 - Energy Storage / Power Transmission / Motor Generators
 - Radio Frequency and Microwave Radiators and Detectors
 - Bio-Medical Engineering
 - Transportation / Ore Separation
- VII. Future Research and Development Needs
 - Possible Developments Within the Next Five Years
 - Speculation Concerning Future Developments
 - Major Unsolved Problems

SUPERCONDUCTIVITY

Course 104/Fee: \$250

Schedule and Location:

October 15-16, 1968, The Biltmore Hotel, New York City

December 12-13, 1968, The International Hotel, Los Angeles

... in brief This seminar will review the historical development of the field to its present technological stage. A short theoretical introduction of the subject of superconductivity will be presented stressing the physical concepts and phenomenological theories. High Field Type II Superconductors, the Josephson Effect, and High Temperature Superconductors will be covered in some detail. Recent technological improvements in high field magnet technology and its application to devices based on the a.c. and d.c. Josephson effect will be discussed. Unique new applications of superconducting technology in bio-medical problems, transportation, ore separation, and other areas give promise of exciting engineering possibilities.

LEON N. COOPER, A.B., A.M., Ph.D.

*Professor of Physics, Brown University
Providence, Rhode Island*

Dr. Cooper obtained his A.B., A.M. and Ph.D. degrees from Columbia University. He was a member of the Institute for Advanced Study, a Research Associate at the University of Illinois, Assistant Professor at the Ohio State University, and was Associate Professor, Professor, and is presently Henry Ledyard Goddard Professor at Brown University.

Dr. Cooper is a consultant to various industrial and educational organizations, in particular, Physical Science Study Committee, Space Technology Laboratories, Inc., and Arthur D. Little, Inc. In conjunction with J. Bardeen and J. R. Schrieffer, Dr. Cooper developed some of the basic concepts in Superconductivity. Dr. Cooper is a NFS Postdoctoral Fellow, Alfred P. Sloan Foundation Research Fellow, John Simon Guggenheim Memorial Foundation Fellow. He received with J. R. Schrieffer the Comstock Prize of the National Academy of Sciences, 1968. He is also a Fellow in the American Physical Society and a member of Phi Beta Kappa and Sigma Xi.

BRIAN B. SCHWARTZ, Ph.D.

*Head, Theoretical Group, Francis Bitter National Magnet Laboratory
MIT, Cambridge, Massachusetts*

Dr. Schwartz obtained his Ph.D. in Physics from Brown University in September, 1959, and has served in industry and universities. He has previously been employed by Hughes Aircraft Company and North American Aviation. He is currently Head of the Theoretical Group at the Francis Bitter National Magnet Laboratory. He has specialized in conducting research on superconductivity, particularly High Field Type II, the Josephson effect, flux quantization; and in the field of magnetism he has been specializing in magnetic impurity in a metal and in the Mössbauer effect.

BERNARD MANOWITZ, B.S., M.S.
Head, Radiation Division, Nuclear Engineering Department
Brookhaven National Laboratory, Upton, L.I.

Mr. Manowitz holds a B.S. degree in Chemical Engineering from the Newark College of Engineering and an M.S. degree in Chemical Engineering from Columbia University. From 1944-1947 he worked at Clinton Laboratories, now Oak Ridge National Laboratory, primarily in the field of pile engineering. He joined Brookhaven National Laboratory in 1947. His responsibilities included the design and construction of the Brookhaven waste disposal system, engineering research on waste processing methods, radioisotope utilization studies, and research and development work in radiation physics and radiation chemistry. From 1960-1962 he was the Associate Head of the Chemistry and Chemical Engineering Division of the Nuclear Engineering Department at Brookhaven. He is now Head of the Radiation Division of the Nuclear Engineering Department. From 1952-1954 he was a member of AEC Waste Processing Committee. He was also an adviser to the delegation at the 1955 Geneva Conference where he presented a U.S. paper on waste disposal; a delegate to the 1959 Warsaw Conference on large-scale radiation sources, and a delegate to the 1964 Geneva Conference where he presented a U.S. paper on chemonuclear processes. Mr. Manowitz is the author of many publications in the fields of waste disposal and applied radiation. With John Lawrence and Benjamin Loeb, he co-authored the book *Radioisotopes and Radiation* which was a presentation volume by the U.S. to the delegates of the 1964 Geneva Conference. Since 1955 he has been an editor of the *International Journal of Applied Radiation*.

He is the chairman of the National Academy of Sciences Committee on Radiation Sources and is a member of the New York State Advisory Committee on Radiation Utilization. In 1965, Mr. Manowitz was made a Fellow of the American Nuclear Society. He has been active in ANS and in the American Institute of Chemical Engineers. In the ANS he has been a director of the Metropolitan Section, a director of the Isotope and Radiation Division and a member of the National Program Committee. He has been the vice chairman and chairman of the Nuclear Engineering Division of AICHE.

MEYER STEINBERG, B.Ch.E., M.S.
Supervisor, Radiation Processing Section
Brookhaven National Laboratory, Upton, L.I.

Mr. Steinberg received his B.Ch.E. from the Cooper Union School of Engineering in 1944 and his M.S. degree in Chemical Engineering from the Polytechnic Institute of Brooklyn in 1949. He holds a Professional Engineer's License in the State of New York. Mr. Steinberg was an Assistant Chemical Engineer with the Manhattan District for the Kellogg Corp. at New York and Oak Ridge, and the University of California at Los Alamos, performing engineering design and process control work for the production of fissionable material. He also served as an

(Continued on p. 6)

INDUSTRIAL USES OF RADIATION

Course 106/Fee: \$200

Schedule and Location:

October 17-18, 1968, The Summit Hotel, New York City

December 12-13, 1968, The International Hotel, Los Angeles

...in brief Although twenty years have been spent in searching for industrial applications of intense radiation fields, only recently have several applications become commercially useful. The technology for manufacturing high voltage machines and radioisotope sources has developed to the point where their use and cost are practical. This seminar will describe those applications of intense radiation fields that have already become commercially feasible, particularly in the fields of agriculture, sterilization of medical supplies and chemical synthesis and modification. The basic principles involved, the technology, and economics will be described and the upcoming applications of this new field will be fully explored.

TOPICS

- I. Worldwide Aspects of Applied Radiation
 - Applications to agriculture
 - Preservation of food
 - Sterilization of medical supplies
 - Chemical Synthesis
 - Product Modification
- II. Review of Nuclear and Radiation Physics
 - Radioactivity
 - The Fission Process
 - Radioisotope sources and their characteristics
 - High voltage machine sources
- III. Package Irradiation Design
 - Illustrative problems
- IV. Radiation Chemistry
- V. Existing and Projected Chemical Processes
 - Dow process for Ethyl Bromide
 - W. R. Grace process of cryovac film
 - Esso process for SAS
 - Polyethylene process—Ozone process

Assistant Chemical Engineer with the consulting firm of Deutsch and Loonam in New York, where he developed novel, heavy chemical, and metallurgical processes. He was an assistant project manager for developing chemical processes by means of high temperature flame reactions, including a process for hydrazine synthesis at the Guggenheim Brothers Laboratories in Mineola, N.Y.

Mr. Steinberg joined the Nuclear Engineering Department at Brookhaven National Laboratory in 1957 and became Supervisor of the Radiation Processing Section in 1961. Mr. Steinberg's major interest is in the development of the use of nuclear energy for the synthesis and production of industrial chemicals. He is the author of many papers and review articles on chemonuclear reactors, applied radiation chemistry, and the recovery of gaseous fission products. He holds several patents on hydrazine production processes. He presented a paper on radiation polymerization at the Second International Congress of Radiation Research in Harrogate, England, in 1962, and papers on fission fragment chemical synthe-

sis and radiation polymerization of ethylene at the IAEA Conference on the Application of Large Radiation Sources in Industry in Salzburg, Austria, in 1963, and at the Fifth Conference on Radioisotopes in Tokyo, Japan. In 1964, Mr. Steinberg presented an invited lecture on Radiation Process Development at the International Congress on the Application of Large Radiation Sources sponsored by the Nederland Atoomforum and the IAEA. In 1965, he presented an invited Radiation Chemistry Plenary Session lecture on "Progress in Chemonuclear and Radiation Chemical Process Development" at the XXth Congress of the International Union of Pure and Applied Chemistry (IUPAC) National Academy of Sciences. Mr. Steinberg is a member of Sigma Xi, the American Institute of Chemical Engineers, the American Chemical Society, the American Technion Society, the Cooper Union Alumni Association, and the American Nuclear Society.

ANTHONY E. SIEGMAN, A.B., M.S., Ph.D.

Professor of Electrical Engineering

W. W. Hanson Laboratories of Physics

Stanford University, Stanford, California

Dr. Siegman received his A.B. from Harvard College, his M.S. in Applied Physics from UCLA, and his Ph.D. in Electrical Engineering from Stanford University in 1957. Since that time he has been a member of the faculty of Stanford University and is currently Professor of Electrical Engineering. He is a recognized international authority in the field of quantum electronics.

Dr. Siegman has been engaged in basic and applied research in the areas of microwave electron tubes, parametric amplifiers, microwave masers, and optical masers and their applications, and has published some 50 technical articles in these fields. He currently directs a research program on lasers and their applications at Stanford University. He holds two patents on microwave-frequency photodevices.

Dr. Siegman is a consultant to the Electro-Optics Organization of Sylvania Electronic Systems—West, Mountain View, California, and the Institute for Defense Analyses, Washington, D.C. He is also a delegate to the APS-OSA-IEEE Joint Council on Quantum Electronics and has been conference Chairman for the 1968 International Quantum Electronics Conference, Miami, Florida, May 1968, and Program Chairman for the 1966 International Quantum Electronics Conference, Phoenix, Arizona, April 1966. Dr. Siegman is a fellow of the Optical Society of America and of the Institute of Electrical and Electronics Engineers (IEEE). He is a member of the American Physical Society, American Society for Engineering Education, American Association of University Professors, Phi Beta Kappa, and Sigma Xi, and a member of the Editorial board for the *Proceed-*

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LASER DEVICES AND APPLICATIONS

Course 103/Fee: \$250

Schedule and Location:

November 19-20, 1968, The International Hotel, Los Angeles

January 21-22, 1969, The Biltmore Hotel, New York City

Spring 1969, Hotel Intercontinental, Geneva, Switzerland

... in brief The field of electro-optical systems or quantum electronics has its current roots in the exciting development of the laser. Technology in this field has been rapidly expanding in two interrelated directions—new types of lasers and in turn many new applications. This seminar is designed to focus the engineer's attention on the most current developments in this field and on the most promising applications of these developments. Problems integrating a laser based sub-system into other sub-systems will be treated. TFI seminar 101, "Holography," is also recommended as a related program.

TOPICS*

- I. Fundamentals of Laser Operation
 - Atomic transitions
 - Maser amplification/oscillation
 - Axial modes and transverse modes
 - Coherence: spectral, temporal, spatial properties
 - Pumping processes
- II. Important Practical Lasers
 - Gas lasers
 - Solid-state lasers
 - Injection lasers
 - Liquid and dye lasers
- III. Laser Techniques
 - Q-switching
 - Propagation and focusing of gaussian beams
 - Modulation (electro-optic, acoustic)
 - Optical heterodyning
 - Dielectric coatings, mirrors, filters
 - Nonlinear optics, harmonic generation
 - Beam deflection, scanning
 - Interferometry, fringe formation
 - Frequency stabilization
- IV. Laser Applications
 - Pulsed ranging
 - Modulated cw ranging
 - Interferometric distance measurement
 - Alignment
 - Communications (multiplexed PCM example)
 - Displays, scanning applications
 - Holography, optical data processing
 - Medical
 - Basic physics
 - Military
 - Wavelength and frequency standards
- V. Forecasts
 - Commercial: markets, business statistics
 - Technological
- VI. Sources of Information
 - Book list
 - Scientific and technical journals
 - Trade magazines
 - Abstracting services
 - Conferences
 - Major commercial sources

* This is intended as a checklist rather than a formal outline.

ings of the IEEE. Dr. Siegman is the author of *Microwave Solid-State Masers* (McGraw-Hill, 1964); and *An Introduction to Lasers and Masers* (preliminary edition), (McGraw-Hill, 1968). He is also the co-editor (with H. Heffner) of the McGraw-Hill Series in Physical and Quantum Electronics.

ROBERT L. BYER, B.A.

Stanford University, Palo Alto, California

Mr. Byer graduated from the University of California in June 1964 with a B.A. in physics. He then joined Spectra-Physics, where during the following three years he was associated with the development of argon-ion and He-Ne laser products, and with the discovery of the pulsed mercury laser. Since 1965 he has carried on graduate work at Stanford University in the field of nonlinear optics. His Ph.D. dissertation work included construction of the first visible cw parametric oscillator (tunable laser). After receiving the Ph.D. degree in the Fall of 1968 he will remain at Stanford doing research and teaching in the Applied Physics Department. He is also at present consulting for Chromatix, a new company formed to produce coherent tunable laser sources.

RICHARD C. HONEY, B.S., Ph.D.

*Manager, Electromagnetic Techniques Laboratory
Stanford Research Institute
Menlo Park, California*

Dr. Honey received a B.S. degree in Physics from the California Institute of Technology in 1945. After serving as a Radio Technician in the U.S. Navy, he attended Stanford University, where he received the degree of Electrical Engineer in 1950, and a Ph.D. degree in Electrical Engineering in 1953. He was a member of the Microwave Oscillator Project at Stanford Electronics Research Laboratory from 1948 to 1952, while writing his dissertation on traveling-wave electron-deflection systems.

In 1952, Dr. Honey joined the staff of Stanford Research Institute, where he has worked on microwave antennas and antenna theory, including radar scanning and instantaneous direction-finding antennas, linear arrays, and leaky-wave antennas. This work has included studies of modern electronic-scanning techniques. He has also been extensively involved in work on microwave components and parametric amplifiers. He has had numerous papers on these subjects published in various technical journals. In August 1960 Dr. Honey became Technical Program Coordinator of the SRI Electromagnetic Techniques Laboratory.

In July 1964, Dr. Honey became Manager of the Electromagnetic Techniques Laboratory. Since that time he has been responsible for a number of laser application programs, particularly in the areas of meteorology, medicine, and oceanography. For the year 1966, Dr. Honey also served as staff advisor for research, assuming technical responsibility for the Institute's own R&D programs.

Dr. Honey is a Fellow of the Institute of Electrical and Electronics Engineers and an Editorial Reviewer for the *Proceedings of the IEEE*. He is also a member of the IEEE Groups on Antennas and Propagation, Microwave Theory and Techniques, and Bio-Medical Engineering, and of the American Physical Society, the Optical Society of America, the Scientific Research Society of America, and Sigma Xi.

DENNIS GABOR, D.Sc., Dr.-Ing., F.Inst.P., F.IEE, F.R.S.
Emeritus Professor in the University of London
and Senior Research Fellow, Imperial College, London
Visiting Professor of Electrical Sciences at the
State University of New York at Stony Brook, L.I., New York
Staff Scientist at the CBS Laboratories, Stamford, Connecticut

Dr. Dennis Gabor was born in Budapest in 1900 and received his Dr.-Ing. in Electrical Engineering at the University of Berlin, in 1927. Following research work at Siemens & Halske, 1927-1933, Berlin, and at the British Thompson-Houston Co., Rugby, England, 1934-1948, he became a Professor of Electrical Engineering at the Imperial College in London with which he remains associated to date. Dr. Gabor has published more than 80 papers on such diverse fields as electrical transients, gas discharges, plasma phenomena, electron optics, optical information theory, physical optics, including the first publications on holography, 1948-1951, starting with the fundamental papers in *Nature* (1948), under the title "A Microscopic Principle," and the papers of "Wavefront Reconstruction Imaging" in the *Proceedings of the Royal Society* (London), 1949. In addition, he has made numerous contributions to the field "technology and the future" including the book *Inventing the Future* (Secker & Warburg, London, 1963; Pelican, London, 1963), translated into 7 languages. Dr. Gabor was awarded the Cristoforo Colombo Prize of the City of Genoa, Italy, for his work in Communication Theory, in 1967.

GEORGE W. STROKE, Ph.D.
Professor of Electrical Sciences and of Medical Biophysics
Head, Electro-Optical Sciences Center, State University of New York
at Stony Brook, Stony Brook, L.I., New York

Dr. George W. Stroke obtained his Ph.D. in Physics from the University of Paris (Sorbonne) in 1960. He is well known for his work in optical diffraction gratings, velocity of light measurements, and most recently for his contributions in originating a number of the contemporary forms of holography since 1962, while a Professor of Electrical Engineering and Head of its Electro-Optical Sciences Laboratory at the University of Michigan. He is a Fellow of the American Physical Society, a Fellow of the American Optical Society, a Senior Member of the IEEE, a Member of the U.S. National Academy of Sciences Commission I of U.R.S.I., etc., and author of more than 75 papers and two books, including over 30 papers in the field of holography, the first book on the subject (*An Introduction to Coherent Optics and Holography*, Academic Press, 1966), translated into Russian in 1967, and most recently of the 320-page "article," "Diffraction Gratings," in the *Handbuch der Physik*. Dr. Stroke's work in holography has twice formed the subject of the "Science" section in *Time Magazine* (March 1966 and March 1968).

HOLOGRAPHY AND ITS APPLICATIONS

Course 101/Fee: \$300

Schedule and Location:

October 15-16, 1968, The Biltmore Hotel, New York City

...in brief It has recently become evident that the field of holography (sometimes called 3-D "lensless photography" or "laser photography") has much wider, much more sophisticated, and certainly much more wide-ranging applications in optics than may have appeared from its original name 'wavefront-reconstruction imaging' under which the field was introduced by Dennis Gabor in 1948. The breadth of this new field will be the principle on which this seminar will be presented. Following a brief general review of the foundations and principles of the field, including the required operational Fourier-transform mathematics, the lectures will stress those applications of holography which are not only generally applicable and fundamental, but which also promise particularly fruitful results in industry, technology, defense research, and at the frontiers of engineering areas such as mechanics, acoustics, electronics, optics, and chemistry, among others, as well as in biophysical, medical and bio-medical research.

TOPICS

Theory of Holography
Experimental Methods and Apparatus
3-D Multi-Color Photography with black-and-white emulsions
Holographic Interferometry (stress and vibration analysis)
Character, Pattern and Shape-Recognition
Optical Computing and Computer-Generated Holograms
Acoustical and underwater Holography
Microwave Holography (side-looking radar applications)
Holographic 3-D Microscopy
Image-Deblurring and Imaging through distorting ("Turbulent") Media
Holographic Memories and Information-Theory Applications

TOPICS

- I. General Considerations
 - Strength of Fibers and Whiskers
 - Fiber Reinforcement
 - Uniaxial Behavior (Rule of Mixtures)
 - Discontinuous Fibers/Effect of Orientation
 - Interfaces
 - Toughness
- II. Reinforcements
 - Whiskers
 - Boron
 - Carbon
 - Glass
 - Other
- III. Metal Matrix Composites
 - Fabrication Techniques
 - Properties and Behavior
 - Applications
- IV. Resin Matrix Composites
 - Types and Fabrication
 - Properties and Behavior
 - Applications
- V. Macroscopic Mechanical Behavior-Static Loads
 - Elastic Constants
 - Stress-strain Behavior: Tension, Shear, Compression
 - Strength and Modes of Failure
- VI. Microscopic Mechanical Behavior-Micromechanics
 - Fiber Reinforcement—Fiber Aspect Ratio
 - Elastic Constants of Parallel Filament Composites
 - Stress Analysis of Matrix
 - Composite Strength
- VII. Mechanical Testing of Composites
 - Specimen Geometry and Stress Analysis
 - Repeated Loading (fatigue) and Environmental Testing
- VIII. Design with Fibrous Composites
 - Design of the Composite Material
 - Design of the Composite Structure
 - Joining and Joints
 - Fabrication, Quality Control and Inspection
 - Safety and Reliability

COMPOSITE MATERIALS

Course 110/Fee: \$225

Schedule and Location:

November 13-14, 1968, The Biltmore Hotel, New York City
 April 8-9, 1969, The International Hotel, Los Angeles

...in brief Some of the most exciting advances in the field of new materials have occurred in what is currently called "composites." Composite materials consist of the mixing and matching of multiple kinds of materials to make them structurally stronger and stiffer, and this also results in other interesting mechanical properties. The application of these composites for engineering purposes requires knowledge about their structural properties. This seminar is designed to familiarize the product engineer with the types of composite materials available, their properties and their potential for new products, and to forecast the expected types of composite materials and their potential future use.

MICHAEL J. SALKIND, Ph.D.

Chief, Advanced Metallurgy, United Aircraft Research Laboratories
 East Hartford, Connecticut
 and Lecturer in Engineering Materials
 Trinity College, Hartford, Connecticut

Dr. Salkind received his Ph.D. in Materials Engineering from Rensselaer Polytechnic Institute. He spent several years as Assistant to the Chief of Research and Engineering at Watervliet Arsenal where he conducted research in the area of whisker and fiber composites. Dr. Salkind joined the United Aircraft Research Laboratories in 1964 where he has held various positions, the most recent being that of Chief of Advanced Metallurgy. Dr. Salkind has specialized in powder metallurgy and sintering, composite materials, fiber and lamellar reinforced materials, and controlled solidification. He is the author of more than 20 publications. He is a member of the AIME Composites Committee, ASM, RESA-Sigma Xi, Chairman of ASTM Committee D-30 on Fibers and Composites, and Consulting Editor of *Fibre Science and Technology*. Dr. Salkind is listed in *American Men of Science* and *Who's Who in the East*.

HERBERT T. CORTEN, B.S., M.S.

Professor, Department of Theoretical and Applied Mechanics
 University of Illinois, Urbana

Professor Corten received his B.S. in Mechanical Engineering from the Illinois Institute of Technology in 1946, and his M.S. in Theoretical and Applied Mechanics from the University of Illinois in 1947. He was an Instructor at Wayne University in Detroit in 1947 and 1948 and has been with the University of Illinois since 1948. During the academic year 1967-68 he was on leave of absence from the University of Illinois and served on the staff of the Oak Ridge National Laboratory. He is the author of three dozen technical papers and is a member of ASME, ASTM, ASEE, and the American Ceramic Society. Professor Corten is listed in *American Men of Science*.

JOHN D. HOFFMAN, B.S., M.S., Ph.D.
Director, Institute for Materials Research
National Bureau of Standards, Washington, D.C.

Dr. Hoffman was designated as Director of the Institute for Materials Research, National Bureau of Standards, on February 1, 1968. He had been Chief of the Polymers Division in IMR, replacing Dr. Gordon S. Kline who retired in December 1963. Dr. Hoffman directed polymer research and polymer standards work at the Bureau. He also personally engages in research. Dr. Hoffman has been with the Bureau since 1954 when he joined the Polymer Structure Section as a physical chemist concerned with theoretical work on dielectric relaxation, and with studies on the dielectric properties and kinetics of crystallization in polymers. In 1956 a Dielectrics Section, under Dr. Hoffman's direction, was established to investigate such areas as dielectric properties of polymers, precision dielectric measurements, and theoretical studies on relaxation phenomena in molecular crystals. He has worked extensively on polymer crystallization theory.

Dr. Hoffman received his B.S. degree in chemistry at Franklin and Marshall College where he received departmental honors in chemistry. In 1948 and 1949, respectively, he received an M.S. degree and a Ph.D. degree in physical chemistry from Princeton University. In 1946, during his Army service, he was awarded the Soldier's Medal. Dr. Hoffman was a Research Associate in the Physical Chemistry Section of the General Electric Research Laboratory in Schenectady, New York, from 1949 to 1954. In 1959 he served as Chairman of the NAS/NRC Conference on Electrical Insulation.

Dr. Hoffman was co-recipient in 1961 of an NBS Special Act of Service Award for an outstanding paper he co-authored with John I. Lauritzen, Jr., on the crystallization of bulk polymers with chain folding. The Washington Academy of Sciences awarded him a certificate of recognition in 1962 "for distinguished service in the science of polymer physics." In February 1965, he received the Department of Commerce Gold Medal Award. In January 1968 he received the 1967 Samuel Wesley Stratton Award for "outstanding contributions in relating physical properties of solids to molecular phenomena and particularly with respect to chain folding in polymers."

Dr. Hoffman is a Fellow of the American Physical Society and a member of the Faraday Society, the American Chemical Society, the Washington Academy of Sciences, and the Washington Philosophical Society. He is also a member of the Editorial Board of the *Journal of Polymer Science* and other journals. Dr. Hoffman has written over 40 original scientific research papers and holds a patent on a process for recovering alumina from clay. He is co-patentee for a method of removing light isotope products from liquid thermal diffusion units.

DR. C. A. J. HOEVE
Section Chief, Molecular Properties and Polymer Characterization
National Bureau of Standards, Washington, D.C.

Dr. Hoeve was born in the Netherlands and received his Doctorandus degree in physical chemistry from the University of Amsterdam in 1950. He received his
(continued on p. 16)

POLYMER CHARACTERIZATION AND ASPECTS OF MODERN POLYMER PHYSICS

Course 112/Fee \$250

Schedule and Location:

November 21-22, 1968, The Biltmore Hotel, New York City
December 17-18, 1968, The International Hotel, Los Angeles

... in brief This seminar will review modern techniques of polymer characterization (osmometry, light scattering, Gel permeation chromatography, etc.), and will give information on recent advances in polymer crystal physics (morphology, melting and crystallization, mechanical and dielectric properties). The course will also discuss the physical properties of amorphous polymers (glass transition, rubber elasticity, swelling) and present information on the preparation, characterization, and properties of metallo-organic polymers.

The appropriate theories will be discussed in simple terms, and throughout the presentations, a special effort will be made to give a clear physical picture of the processes involved. In most cases, this will be done in molecular terms. Emphasis will be placed on relating molecular structure (and in the case of crystalline polymers, morphology) to physical properties of interest.

TOPICS

- I. CHARACTERIZATION
 - Solution Properties: Molecular Weight Measurements
 - Osmometry
 - Light Scattering
 - Centrifugation
 - Viscosity
 - Vapor Pressure Osmometry
 - Gel Permeation Chromatography
- II. CRYSTALLINE POLYMERS IN BULK
 - Crystallography and Morphology
 - Melting and Crystallization
 - Mechanical and Dielectric Properties
- III. AMORPHOUS POLYMERS
 - The glass transition
 - Rubber Elasticity
 - Swelling
- IV. INORGANIC POLYMERS (METALLIC-ORGANIC)
 - Preparation and Characterization
 - Physical Properties

Doctor of Science degree cum laude from the University of Pretoria, South Africa. From 1955 to 1956 he was at the National Research Council in Ottawa, Canada, and spent the following year as a Research Associate at Cornell University. Dr. Hoeve was a Senior Fellow at the Mellon Institute in Pittsburgh from 1957 to 1963. Since 1963 he has been with the National Bureau of Standards and is presently section chief of two sections: Molecular Properties and Polymer Characterization. Dr. Hoeve has approximately 25 publications. His major field of interest is the physical chemistry of polymers, such as solution properties and rubber elasticity. Furthermore he has studied the elastic properties of proteins. Other areas that he has published in include the theory of micelle formation in detergent solution and the basic mechanism of muscle contraction. At present, he is the leader of a program that issues polymers as molecular weight standards.

EMANUEL HOROWITZ, B.S., M.S., Ph.D.
*Assistant to the Director, Institute for Materials Research
National Bureau of Standards, Washington, D.C.*

Dr. Horowitz received his B.S. degree from the City College of New York, his M.S. from George Washington University. He did graduate work at the University of Illinois and obtained a Ph.D. degree from George Washington University. His Ph.D. dissertation was on "Coordination Polymers of Bis (8-hydroxyquinoline) Derivatives." Dr. Horowitz was a research chemist at the Smithsonian

EARL R. PARKER, B.S., M.S., Ph.D.
Professor of Metallurgy, University of California, Berkeley

Professor Parker has been with the University of California since 1944. His special field of research is in the mechanical behavior of materials. He has received the following honors for his contributions to metallurgical research: Gold Medal Award from the AIME for the best research publication for the year 1956; presented the 1957 Campbell Memorial Lecture, "Modern Concepts of Flow and Fracture"; presented the Williams Lecture Series at the M.I.T. in November, 1957; received the Distinguished Citizens Award—Denver, Colorado, in October, 1958; received the John Simon Guggenheim Fellowship in 1960; presented the Sauveur Achievement Award from the American Society for Metals in 1964—an award given in recognition of pioneering metallurgical achievements which have stimulated organized work along similar lines to such an extent that a marked basic advance has been made in metallurgical knowledge; in June, 1966, Dr. Parker received the Distinguished Achievement Medal from the Colorado School of Mines. Professor Parker was made a Fellow of the Metal-

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Institution from 1949 to 1951. Since 1951, he is an analytical chemist with the National Bureau of Standards, engaged in fundamental research in chemistry of inorganic polymers. He is also the assistant to the director at the Institute for Materials Research. Dr. Horowitz published about 16 technical papers including a number on polymer physics and chemistry. He is a member of the American Chemical Society and the Washington Chemical Society, Alpha Chi Sigma, Sigma Xi and Phi Lambda Upsilon.

R. K. EBY, Sc.B., M.S., Ph.D.
*Chief, Polymer Crystal Physics Section
Institute for Materials Research
National Bureau of Standards, Washington, D.C.*

Dr. Eby obtained his Sc.B. in Physics from Lafayette College and his M.S. and Ph.D. degrees from Brown University. Dr. Eby was a physicist, Plastics Department, at the duPont Experimental Station from 1957 to 1963. Since 1963 he is a physicist, Polymer Division, National Bureau of Standards, and Chief, Polymer Crystal Section at the Institute for Materials Research, NBS, since 1967. Dr. Eby published about 22 original research papers. He is a Fellow in the American Physical Society, a member of the Acoustical Society of America and the Electron Microscope Society of America. He also belongs to Phi Beta Kappa and Sigma Xi fraternities.

ADVANCED MATERIALS PRESENT STATUS AND FUTURE PROSPECTS

Course 113/Fee: \$350

Schedule and Location:

November 12-14, 1968, The Fairmont Hotel, San Francisco
January 14-16, 1969, The Biltmore Hotel, New York City

... in brief Many new materials and thus whole new products never before conceived are emanating from research laboratories at the present time. The engineers are confronted with perhaps the fastest changing technology in the world today. The speed of change in this technological field of materials is obsoleting many products before they have proceeded through the production engineering state. This seminar is designed to provide up-to-date information on the newer engineering materials. There will be emphasis in the course on engineering failures of conventional as well as new materials from both the metallurgical and continuum mechanics viewpoints. The materials considered in this seminar will include metals, ceramics, plastics, and composites. The current state-of-the-art will be discussed in detail. The latest research results will be presented and the future prospects for improved materials are also part of the program.

TOPICS

I. REVIEW OF FUNDAMENTALS OF FLOW AND FRACTURE

A. Principles of plastic flow

Slip planes and slip directions in crystals
 Role of dislocations in plastic flow and strain hardening
 Effects of alloying elements
 Temperature dependence
 Influence of strain rate
 Behavior of polycrystalline aggregates
 Strengthening effects of second phase particles

B. Mechanisms of Fracture

Fracture processes
 Effect of alloying elements
 Temperature dependence
 Influence of strain rate
 Behavior of polycrystalline aggregates
 Influence of second phase particles
 Delayed fractures
 Fatigue
 Brittle fracture caused by cracks in engineering structures

II. SOLID STATE REACTIONS, RESULTANT MICROSTRUCTURES AND ASSOCIATED PROPERTIES

Kinds of Solid State Reactions

Solid State Reactions in Steel
 Austenite, Martensite, Pearlite, Bainite
 Microstructure and Associated Properties in Steel
 Strengthening by thermomechanical processes
 Deformation before austenite transformation
 Deformation during austenite transformation
 Deformation after austenite transformation

Solid State Reactions, Microstructures and Properties in Titanium alloys.
 Solid State Reactions, Microstructures and Properties in Al, Cu, and Be alloys.

III. NON-METALLIC ENGINEERING MATERIALS

Ceramics/Amorphous Materials—Glasses/Crystalline Materials
 Plastics/Thermoplastic polymers
 Thermosetting Polymers
 Elastomers
 Cement and Concrete
 Properties of Portland cement
 Low heat cements/Fast setting cements
 Low shrinkage and expanding cements
 Reinforced concrete/Prestressed concrete
 Recent advances in design and use of concrete
 Composites/Materials and Microstructure
 Structure vs Properties
 Useful Systems

lurgical Society of AIME in 1966, one of the highest honors the Society can confer on a member—since its establishment in 1962, only 30 men from a membership of over 11,000 have been so honored.

Professor Parker has written more than 100 technical publications which include one book, *Brittle Behavior of Engineering Structures*, and a second book, of which he was the editor, entitled *Materials for Missiles and Spacecraft*. From 1958 to 1960 he was a Trustee of the American Society for Metals. He has been a consultant for Naval Ordnance Test Station, China Lake, California; Lawrence Radiation Laboratory, Livermore, California; Scientific Laboratory, Ford Motor Company, Dearborn, Michigan; General Atomic, Inc., San Diego, California; Aerojet-General Corporation, Sacramento, California; General Electric Company, Richland, Washington; member of the National Advisory Committee for Aeronautics—Committee on Heat Resisting Materials; member, Air Force—National Academy of Sciences Long-Range Planning Committee. Professor Parker has served as Chairman of the Department of Mineral Technology for five years, from 1953 to 1957 and again from 1965 to 1966. He was Director of the Institute of Engineering Research from 1957 to 1964. In October 1966 Professor Parker was made Vice President of the American Society for Metals and was named its President in 1967.

VICTOR F. ZACKAY, B.S., M.S., Ph.D.

*Professor of Metallurgy, Department of Mineral Technology
 College of Engineering
 and Associate Head, Inorganic Materials Research Division
 Lawrence Radiation Laboratory, University of California, Berkeley*

Before joining the University of California, Professor Zackay was an Assistant Professor at the Pennsylvania State College from 1951 to 1952; Research Metallurgist, Supervisor, Assistant Manager, Scientific Laboratory, Ford Motor Company, Dearborn, Michigan, from 1952 to 1962. Professor Zackay obtained his B.S., M.S., and Ph.D. degrees at the University of California. He received the following professional awards: American Medical Association and American Society of Orthopedic Surgeons Award (materials engineering in surgical procedures); Henry Marion Howe Medal for the technical paper of highest merit to appear in the 1960 volume of Transactions, American Society for Metals (paper entitled "The Strength of Martensite Formed From Cold-Worked Austenite," J. C. Shyne, V. F. Zackay, and D. J. Schmatz). Dr. Zackay is a member in ASM and in their Advisory Technical Awareness Council (ATAC), in AIME, and Sigma Xi. He is Chairman, Metallurgical Engineering Application Review Committee—Northern California, State Board of Registration for Civil and Professional Engineers.

Professor Zackay has edited or co-edited three books: *Response of Metals to High Velocity Deformation*; *Decomposition of Austenite by Diffusional Processes*; and *High Strength Materials*. Dr. Zackay also has published several dozen papers in the fields of ceramics, very high strength metals, fracture, and high field superconductors.

...in brief The use of physical methods to evaluate, characterize and inspect materials, without impairing their usefulness, has developed into a technology known as Nondestructive Testing. The terms inspection and evaluation have broad implications and imply: the measurement of dimensions and properties; determination of homogeneity and integrity; conditions of physical, chemical or metallurgical treatment; and the effect of service or environmental conditions. The purpose of this seminar is to demonstrate to engineers and management the potentialities of nondestructive testing technology for use within their own operations and for development of a new instrument market. During this seminar the basic principles of the various methods of nondestructive testing will be reviewed; new developments of techniques and instrumentation will be discussed in detail. The advantages and limitations of each method will be described and the application of this technology to a variety of industrial and materials problems will be presented. The participants in the seminar will be given an opportunity to discuss problems of special interest in their field of work or industry.

TOPICS

- I. Introduction to Nondestructive Testing
 - What is Nondestructive Testing Technology?
 - Place of Nondestructive Testing in the Quality Assurance Program
 - Uses of Nondestructive Testing
 - Failure Analysis
 - The Philosophy of Nondestructive Testing
- II. Discussion of the Basic Principles of the Various Methods
 - Visual
 - Penetrant
 - Leak and pressure
 - Thermal
 - Radiography*
 - Ultrasonics*
 - Eddy Current*
 - Magnetics
 - Microwaves
- III. Application of Methods Discussed in II to Specific Problems
- IV. Discussion of Problems of Special Interest to Participants
 - V. The Future of Nondestructive Testing
- VI. Nondestructive Testing and Management

*Major emphasis given to these three methods.

NONDESTRUCTIVE TESTING AND QUALITY ASSURANCE

Course 107/Fee: \$200

Schedule and Location:

October 24-25, 1968, The Biltmore Hotel, New York City
 December 10-11, 1968, The International Hotel, Los Angeles
 February 20-21, 1969, The Biltmore Hotel, New York City
 Spring 1969, Hotel Intercontinental, Geneva, Switzerland

WARREN J. MCGONNAGLE, B.A., M.S., Ph.D.
Associate Director, Associated Midwest Universities
Argonne, Illinois

Dr. McGonnagle received his Ph.D. in Physics at the University of Oklahoma in 1947. He is well known for his background in the Physics of Nondestructive Testing, having formed and chaired a large number of symposia in this field. His broad background in physical research and applications began at MIT where he worked in the Optical Spectroscopy Laboratory. He has been a Physicist with the Manhattan Project at Oak Ridge, Tennessee, as well as a research and applied physicist with the Southwest Research Institute, the IIT Research Institute, and currently with the Associated Midwest Universities. He has published over 50 papers in this field and in the field of peaceful use of atomic energy as well as a significant number of books.

Dr. McGonnagle has personally developed many new techniques for nondestructive testing using ultrasonics, radiation detection, isotope applications, and thermal testing. He has pioneered the techniques for weld examination and evaluation using ultrasonics and radiography, and was the developer of an ultrasonic bond testing technique used in nuclear fuel evaluation. He was past chairman of the Administrative Committee on Research of the American Society for Testing and Materials.

ROBERT V. WOLF, B.S., M.S.
Professor of Metallurgical Engineering
University of Missouri, Rolla

Prof. Wolf obtained his B.S. and M.S. in Mechanical Engineering at the Missouri School of Mines and Metallurgy. He is currently teaching courses in Metals Casting, Nondestructive Testing, Welding Metallurgy, and Metals Processing at the University of Missouri. Prof. Wolf is a member of the American Foundrymen's Society, the Society for Nondestructive Testing, The American Society for Metals and Metallurgical Society of AIME, American Society for Engineering Education, and American Welding Society. He is a consultant to a number of industrial firms. Prof. Wolf received the Outstanding Teacher Award, UMR, 1966-1967 and 1967-1968 School Years.

TOPICS

I. FUSION WELDING WITHOUT PRESSURE

A. Arc Welding Processes

Physical, thermal and electrical characteristics of the arc heat source

Arcs, controls, and power supplies

Permanent electrode arc welding processes

Consumable electrode arc welding processes

Special electrical devices for arc welding

B. Heat Sources other than the Conventional Open Arc for Fusion Welding

Flames/Plasma Arc/Electron Beam/Laser/Electroslag

II. PRESSURE WELDING WITHOUT FUSION

A. Pressure Welding at Elevated Temperature

Forge and pressure upset butt welding

Diffusion bonding/Thermo-compression bonding

Friction welding/Heat sources for non-fusion pressure welding

B. Pressure Welding at or near Ambient Temperature

Cold Welding/Ultrasonic Welding/Explosive Welding

III. PRESSURE WELDING WITHOUT FUSION—RESISTANCE WELDING

A. Spot, Seam and Projection Welding

B. Flash Welding

C. Percussive Welding

IV. SOLDERING AND BRAZING

A. Fundamentals of Brazing

Wetting and promotion of wetting of solids by liquid metals

Capillary flow

B. Filler Materials

Basic metallurgical requirements/Examples of compatible combinations

C. Environment Control in Brazing

Fluxes/Atmosphere/Vacuum

D. Heat Sources for Brazing

Chemical flame (torch)/Furnace brazing/Dip brazing

Other heat sources (electron beam, resistance, block brazing, etc.)

E. Joining of Inorganic Non-Metals (glass, ceramics, graphite, carbides, and similar solids)

V. MECHANICAL PROPERTIES AND BEHAVIOR OF WELDED AND/OR BRAZED STRUCTURES

A. Modern Testing Techniques

B. Mechanical Behavior of Welds

C. Mechanical Behavior of Brazed Joints

VI. FUTURE DEVELOPMENTS AND TRENDS IN JOINING MATERIALS

A. Processes Expected to Exhibit Rapid Growth and Continuing Developmental Change

B. Processes Expected to Retain Approximately Their Present State of Importance

C. Processes of Present Importance Threatened with Partial or Complete Obsolescence

ADVANCED JOINING TECHNIQUES

Course 111/Fee: \$200

Schedule and Location:

November 19-20, 1968, The Biltmore Hotel, New York City

December 10-11, 1968, The International Hotel, Los Angeles

...in brief Exploding technology has produced many new materials which have led to myriad new products. The concomitant explosion of new products has produced a rapid expansion of new applications in space, deep ocean, and even the home environment. These products, applications and environments have presented engineers who design these products with a whole host of new problems in how to join similar and dissimilar materials. With the rapid advance in materials technology in general, even the available new processes for joining materials have also rapidly advanced. The seminar discusses the most advanced methods for joining materials and how to design and produce new products.

CLYDE M. ADAMS, Jr., D.Sc.

Pelton Professor of Metallurgical Engineering

University of Wisconsin, Milwaukee

Dr. Adams served with the U.S. Navy Seabees in the Pacific during World War II and then completed his undergraduate and graduate training at MIT, receiving his Doctor of Science Degree in 1953, and was on the Metallurgy Department Faculty at MIT from 1952 to 1958, as Abex Corporation Professor of Metallurgy from 1964 to 1968. At MIT Dr. Adams was in charge of the Welding Laboratory and also co-director of the Ice Research Laboratory. He has been primarily concerned with teaching and research in the field of materials processing, including the areas of welding, fabrication, and casting, in which he has over 60 publications, and has specialized in the general subjects of heat and mass transfer in materials processing and solidification. Dr. Adams has been active as a consultant to various government agencies (U.S. Navy Bureau of Ships, Army Ordnance, Army Engineer Corps, and the Atomic Energy Commission) as well as industry, insurance companies, and financial institutions.

Dr. Adams is a Registered Engineer in the State of Massachusetts.

GERALD M. SLAUGHTER, B.M.E., M.M.E.

Supervisor, Welding and Brazing Research

Oak Ridge National Laboratory, Oak Ridge, Tennessee

Mr. Slaughter is currently in charge of welding and brazing research at the Oak Ridge National Laboratory where he has served since 1951. He holds a B.S. and M.S. in Metallurgical Engineering from Rensselaer Polytechnic Institute. He is the author of approximately 40 papers in the technological area of joining techniques and also holds eight patents. Mr. Slaughter has been an officer in the American Society of Metals and the American Welding Society. He also has been Chairman of the Subcommittee on Brazing Research of the Welding Research Council and a member of the American Welding Society's Brazing and Soldering Committee and three of its subcommittees.

SEYMOUR CALVERT, B.S.Ch.E., M.S.Ch.E., Ph.D.Ch.E.
Dean of Engineering
Director, Statewide Air Pollution Research Center
University of California, Riverside

Dr. Calvert is Dean of Engineering and Director of the Statewide Air Pollution Research Center at the University of California, Riverside, since 1967. His professional experience includes 14 years in research, process and equipment development, research administration and consulting, and nine years in teaching. Dr. Calvert obtained his B.S. degree in Chemical Engineering from the Michigan College of Mining and Technology and received his M.S. and Ph.D. degrees in Chemical Engineering from the University of Michigan. He is a registered professional engineer in Michigan, Ohio and Pennsylvania.

During his service in the U.S. Army from 1944 to 1946, Dr. Calvert was associated with the Manhattan District Eng. at Los Alamos, New Mexico, as a research engineer. From 1947 to 1949, he worked as a research engineer at the Battelle Memorial Institute. Dr. Calvert then was a project leader engaged in research and process development with the Vitro Corporation and a research engineer with E.R.I. at the University of Michigan working on fundamentals of small particle collection and the flow of pastes for paste-fueled nuclear reactors. In 1957, Dr. Calvert was appointed Associate Professor of Chemical Engineering at the Case Institute of Technology. From 1963 to 1967 he was director of the Center for Air Environment Studies and Professor of Mechanical Engineering at Pennsylvania State University. Dr. Calvert's experience includes consulting work with agencies and private industry. He specializes in research on air and gas cleaning equipment (particulate and gas removal), research on air pollution system definition and analysis, design of industrial air pollution control equipment, and design of controlled environment systems.

From 1958-1961, Dr. Calvert served as Air Pollution Control Officer for Brook Park, Ohio, and drafted its air pollution ordinance. He was Chairman of the Cleveland Advisory Board on Air and Water Pollution from 1960 to 1961. He has also served as a member of the Air Pollution Training Committee of the U.S. Public Health Service. Presently, he is on the Board of Directors of the Air Pollution Control Association and Chairman of the Research Committee of APCA. Dr. Calvert has just been appointed to the U.S. Public Health Service Air Quality Criteria Advisory Committee and is Chairman of the subcommittee on particulates.

(Second faculty member to be announced)

AIR POLLUTION

Course 120/Fee: \$250

Schedule and Location:

December 10-11, 1968, The International Hotel, Los Angeles
January 14-15, 1969, The Biltmore Hotel, New York City

TOPICS

- I. The nature of air pollution
Effects
Sources
Atmospheric transport
- II. Definition of the air environment
Sampling and analysis
Atmospheric modelling
- III. Pollution control technology
Source modification
Gas phase pollutants
Particulate pollutants
- IV. Sociological and political factors
Attitudes and perception
Community structure and dynamics
Law and administration
Economics
- V. Future trends
Changes in sources
Processes and devices requiring revision

... in brief Air Pollution enters many disciplinary domains. The usual first requirement is to be able to see the whole problem. For many people this is the essential need; once they can perceive the problem and the nature of its interactions with variables they can proceed to apply their professional skills as developed within their own disciplines. This seminar will provide sufficient background so that the participant will be aware of all major aspects of the problem and can be confident that his efforts are appropriate. The systems approach is mandatory because there are many alternative routes to alleviate the undesirable effects of pollution. The seminar will provide fundamental information useful for new product development, for air pollutant sampling and analysis, or for the removal (control) of pollutants. It will also cover new processes or devices development useful in achieving lower pollutant emission as well as minimization of pollution from an existing operation. Also, the problems of working with the community (sociological implications) will be discussed.

... in brief In the last decade the exploitation of space served as the fundamental basis for the development of whole new areas of technology. In the next several decades, it is the exploitation of the oceans which will lead to ever more new products, new processes, new theories. To understand this vast new potential, it is necessary to understand the environment in which these new products and processes will be operating. This course is designed to identify the current operations, research and development projects and the deficient areas which need development, and the present advance planning of new techniques and equipment for operating on the sea floor. The kinds of new materials useful or necessary for deep submersible operations will be discussed. The geology of the sea floor will also be covered and the physiological, psychological and life support aspects of undersea operations will be described. These areas are the necessary prerequisites to understanding how the oceans may be exploited for products and processes. It has been stated that the potential in operating in deep ocean is far greater than the potential which we might have obtained in space. Therefore, the development of products and processes will be conditioned by a knowledge of the environment which is considerably different from that of space and, certainly, very different from our land-oriented environment.

TOPICS

- I. Sea Floor Engineering
 - Construction/Surveys
 - Search and Recovery/Salvage
 - Oil and Mineral Extraction
 - Undersea Work
 - Divers/Personnel within Vehicles/Remote Surface Craft*
- II. Deep Submersible Materials and Construction
 - History
 - Submersible Types
 - Materials Interdependence and Characteristics
 - New Materials/Joining/Corrosion
- III. Sea Floor Geology
 - Topography, Structure and Sediments
 - Sea Floor Surveying and Sampling
 - Scuba Divers/Submersibles/Acoustic Profiling/Deep Sea Drilling*
 - Mass Physical Properties
 - Collection and Storage of Specimens/Shear Strength/Elastic Properties*
- IV. Life Support, Physiology and Psychology
 - Diver Performance
 - Classification/Measurement*
 - Work Output Underwater
 - Environmental Elements
 - Task Design

SEA FLOOR TECHNOLOGY

Course 121/Fee: \$325

Schedule and Location:

October 28-30, 1968, The San Francisco Hilton

December 9-11, 1968, The Americana Hotel, New York City

DONALD A. WILSON, B.S., Ph.D., Hon.Sc.D.

*Director of the San Diego Center, Naval Undersea Warfare Center
and Assistant Technical Director for Sensors
San Diego, California*

Dr. Wilson received his B.S. degree from Geneva College, Beaver Falls, Pa., in 1930, which also awarded him an Honorary Doctor of Science Degree in 1965. He received his doctorate in physical chemistry from the John Hopkins University. Dr. Wilson was an instructor at John Hopkins University, an instructor in physiological chemistry at the University of Pittsburgh, School of Medicine, where he also was an assistant professor from 1941 to 1945. He was a research associate in chemistry with Stamford University, a scientist at Woods Hole Oceanographic Institute, a physicist with the U.S. Navy Electronics Laboratory where he also served as Associate Technical Director for Underseas Technology. In 1967, Dr. Wilson was appointed Director of the San Diego Center, Naval Undersea Warfare Center, San Diego. He also serves as Assistant Director for Sensors.

As the Director of the San Diego Center he supervises, through subordinate department and division heads, about 450 personnel, serving as advisor and providing overall policy and management direction. As Assistant Technical Director for Sensors, he is responsible for research, development, test and evaluation of underwater acoustic sensors. With other Assistant Technical Directors and high-level staff members, he collaborates in planning, directing, and evaluating the progress of the overall scientific program of the Center.

Dr. Wilson has a national reputation as a leading scientist in undersea technology and he represents the Center or the Navy as appropriate at top level conferences, committees, and planning groups in this area. He actively participates in attracting high-level talent to the Center, and coordinates the work of underseas technology with that of other areas of the Center insuring the best use of talent and facilities toward accomplishing the Center's mission. Dr. Wilson is particularly noted for his work in undersea warfare, underwater acoustics and sonar technology. He has written more than 35 scientific papers, 50 or more job-related technical reports, two laboratory manuals, and a textbook. For his work with the Polaris Ad Hoc Group he was awarded a Secretary of the Navy Certificate of Commendation in 1966. Dr. Wilson is a member of Sigma Xi, Gamma Alpha, and is a Fellow of the Acoustical Society of America.

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EDWIN L. HAMILTON, Ph.D.

*Supervisory Oceanographer, Naval Undersea Warfare Center
San Diego, California*

Dr. Hamilton is a native of Sherman, Texas, and received his doctorate in geology from Stanford University in 1952. He came to the Center's predecessor, Navy Electronics Laboratory Center, in 1951, from the University of Washington, where he was a lecturer.

Dr. Hamilton has participated in many oceanographic expeditions, namely the FASOR I and II cruises of 1964 and 1966 to the western Pacific to collect acoustical and oceanographic data. In 1960, he participated in the oceanographic expedition to the Bering and Chukchi Seas; in 1952, the Capricorn Expedition to Eniwetok and the Shuttle Expedition to Central America; and in 1950, the Mid-Pacific Expedition to Bikini. Dr. Hamilton has extensive experience in deep submergence work having participated in dives in the TRIESTE I and DEEPSTAR. He is also a qualified SCUBA diver. As Supervisory Oceanographer at the Naval Undersea Warfare Center he specialized in marine geology.

Dr. Hamilton is a retired Marine Corps Colonel. He was a member of the Marine rifle team and won three matches at the National Rifle Matches in 1939-40. In World War II he was wounded in combat on Bougainville. Dr. Hamilton is a member of the Geological Society of America, American Geophysical Union, and American Association of Petroleum Geologists.

HOWARD R. TALKINGTON

*Project Manager for Deep Ocean Engineering,
Naval Undersea Warfare Center
San Diego, California*

Mr. Talkington is a native Californian, born in Los Angeles, and a graduate of Huntington Park High School, and the University of Southern California School

of Engineering (Civil). He has a background of 17 years in ASW-type work. Mr. Talkington joined the Naval Undersea Warfare Center upon graduation from USC in 1951. He presently heads the Ocean Systems Division of the Ocean Technology Department. He is also the NUWC SUBROC Project Manager, is responsible for technical programs and technical support at the Center's San Clemente Island test range, is the NUWC Deep Submergence Systems Project Manager, (including the NUWC responsibilities in the SEALAB Program), and was the Project Manager of the NUWC effort in recovery of the hydrogen bomb off Palomares, Spain.

He also designed range facilities at NUWC and was heavily involved in various phases of the Center's work on ASROC, SUBROC, POLARIS, and torpedo programs. Mr. Talkington is a member of the U.S. Naval Institute, Marine Technology Society, American Society of Civil Engineers.

GERSHON WELTMAN, B.S., M.S., Ph.D.

*Assistant Professor of Engineering
Head, Underwater Research Facility, Department of Engineering
University of California, Los Angeles*

Dr. Weltman received his B.S., M.S., and Ph.D. degrees in Engineering, specializing in Biotechnology, from University of California at Los Angeles. As Assistant Professor of Engineering and Head of the Underwater Research Facility at the University of California, Dr. Weltman teaches and conducts research in several human factors areas at the UCLA Biotechnology Laboratory.

Dr. Weltman spent a year as a NATO Fellow at the Weizmann Institute of Science in Israel. He contributed numerous papers, reports and presentations based on his University research and on consultant work for the aerospace industry.

NUCLEAR MEDICINE

Course 105/Fee: \$250

Schedule and Location:

December 12-13, 1968, Americana Hotel, New York City
February 25-26, 1969, The International Hotel, Los Angeles

JAMES S. ROBERTSON, M.D., Ph.D.

*Brookhaven National Laboratory, Upton, L.I., New York
Senior Scientist and Head, Medical Physics Division*

A pioneer among research scientists in the field of nuclear medicine and computer applications to the field of medicine, Dr. Robertson obtained his M.D. from the University of Minnesota and his Ph.D. in Physiology and Medical

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... in brief The potential uses of the results of scientific research have been felt in many technological areas other than the one where the results were initially classified. In the field of medicine this has been especially true. The results of research in the uses of nuclear radiation or nuclear energy have opened whole new possibilities in the ability to diagnose medical problems and to provide additional means of therapy. With a rapidly rising expenditure of personal income and rapidly increasing commercial insurance and social insurance programs for medical payments, a whole field of possibilities for technologically based industry has emerged. This seminar reviews the underlying applicable research results in medical problem detection, the uses of detection, the new pharmaceuticals available, the instrumentation requirements and the applications of computers to this new field of Nuclear Medicine.

TOPICS

I. Introduction

Definition and scope of field
General areas of applications

II. Radioactive nuclides

Particle emitters/Gamma ray emitters

III. Dosimetry

Definitions of roentgen, rad, RBE
Maximum permissible doses

External measurement methods

Calculations for internally-distributed emitters,
including discussion of MIRD recommendations

IV. Radiobiology

Clinical syndromes

Physical chemical mechanisms/Cellular effects

Dose-effect modifying factors

V. Nuclear reactions

Radioactive decay processes/Activation

VI. Radiation sources

Nuclear reactors/Particle accelerators/Nuclide generators

VII. Radiation detection methods

Film/Electrometers/Geiger and Proportional counters/Scintillation counters

Thermoluminescent detectors

Solid state (germanium) detectors/Counting statistics

VIII. Data processing systems

Scalers/Ratemeters/Pulse-height analyzers/Scanners

Whole-body counters/Computers/Ancillary equipment

IX. Tracer methods

Radiochemical requirements/Kinetic analysis

X. Radiopharmaceuticals

Characteristics/Standards/Biological considerations/Short-lived nuclides

XI. Imaging systems and applications

Basic principles

Statistics and data presentation

Instrumentation

Specific organ studies

XII. Other diagnostic applications

Blood pool/Red cell kinetics and iron metabolism

Gastrointestinal studies/In-vitro tests

XIII. Therapeutic applications

Parenteral/Interstitial/Teletherapy

XIV. Activation analysis

Principles/Selective activation/Selective detection/Applications

Physics from the University of California. He has been a Medical Officer in the Navy, a practicing physician, and a research scientist with the U.S. Naval Research and Development Laboratories in San Francisco and with the Brookhaven National Laboratory for over 15 years. At BNL, Dr. Robertson is the Head of the Medical Physics Division.

Dr. Robertson has authored approximately ninety papers in the field of nuclear medicine and computer applications. He is a member of several important scientific societies and is a licensed physician in Minnesota, California and New York. He is listed in *American Men of Science* and *Who's Who in the East*.

HAROLD L. ATKINS, B.S., M.D.

Scientist, Medical Department

Brookhaven National Laboratory, Upton, L.I., New York

Dr. Atkins received his B.S. degree from Yale University and his M.D. degree from Harvard Medical School. He is certified by the American Board of Radiology and is a licensed physician in the States of Massachusetts, Connecticut, New York, and California. He has also been an American Cancer Society Fellow.

Dr. Atkins has been appointed Scientist in the Medical Department of Brookhaven National Laboratory. He also held appointments in Radiology at Grace-New Haven Community Hospital, Columbia-Presbyterian Medical Center, and Hospital of the Medical Research Center, Brookhaven National Laboratory. He has been a consultant in Radiotherapy and Nuclear Medicine to the U.S. Public Health Service.

In addition to research laboratory and hospital appointments, Dr. Atkins has taught Radiology in a number of important university medical centers. He is a member of several key professional societies and has published over 35 papers in the field of Nuclear Medicine.

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Fees are payable in advance, unless special arrangements are made. Full refunds will be made for cancellation if notification is received up to one week prior to the presentation of the seminar. Substitutions are permitted at any time.

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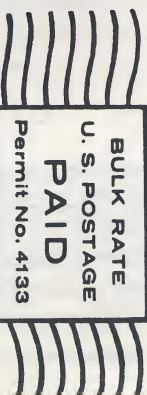
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